United States Environmental Protection Agency
Region 10
Seattle, WA 98101

Reply To
Attn Of: ECO-087

Fourth Draft
w/OGC Review
May 8, 2001

Brigadier General Carl A. Strock
U. S. Army Division Engineer
Department of the Army
Northwestern Division of the Corps of Engineers
P.O. Box 2870
Portland, OR 97208-2870

Dear General Strock:

The U. S. Environmental Protection Agency (EPA) appreciates the strong working relationship and accomplishments we have established and developed with the Northwestern Division of the U.S. Army Corps of Engineers (Corps) under your leadership. Our respective staff and managers have been working together over the past year to develop a strategy for a Water Quality Plan for the Columbia and Snake River Mainstem. Our joint work efforts on the "2000 National Marine Fisheries Service (NMFS) Biological Opinion, Operation of the Federal Columbia River Power System," provide a national model for the integration of the Clean Water Act and Endangered Species Act. We are providing a letter to the Corps to clarify EPA's expectations on specific future work efforts and specific EPA and Corps commitments to aid these work efforts. This letter outlines the expectations and commitments of EPA in four specific areas: the Columbia Mainstem Total Maximum Daily Load, Engaging Other Snake River Managers, Augmented Temperature and Dissolved Gas Monitoring, and the Corps' forthcoming Record of Decision.

Columbia Mainstem Total Maximum Daily Load

As you know, the states of Idaho, Oregon, and Washington are working with EPA Region 10 in the development of Mainstem Total Maximum Daily Loads (TMDLs) for dissolved gas and water temperature. These TMDLs characterize the sources of total dissolved gas and temperature loadings and allocate those loadings to meet state and tribal water quality standards. We understand that the Corps has agreed to coordinate with EPA and the states on this TMDL effort. We are providing the following information to help define the TMDL coordination needs. (This information was included in the September 29, 2000, letter from Charles Findley, EPA, to Donna Darm, NMFS, stating comments on the Draft Biological Opinion.)

- The Corps, with the other Action Agencies (Bonneville Power Administration and Bureau of Reclamation), should commit to fully support the development and implementation of the Columbia and Snake River Mainstem dissolved gas and temperature Total Maximum Daily Loads (TMDLs) currently being developed by EPA and the states of Idaho, Oregon and Washington in coordination with the Columbia Basin Tribes. EPA's specific expectations include:
  - The Corps, with the other Action Agencies, should commit to share data and modeling to assist in the development of TMDLs.
  - The Corps should allocate $1 million of the FY2002 Columbia River Fish Mitigation Program budget to augment technical analyses necessary for TMDL development.
  - The Corps, with the other Action Agencies, should commit to develop, by December 31, 2001, a specific list and time schedule of both short and long term measures to reduce temperature in the Columbia and Lower Snake mainstem with the goal of achieving TMDL allocations. This time line is consistent with the current TMDL work effort .
  - The Corps, with the other Action Agencies, should commit to develop more detailed water quality improvement cost estimates for mainstem projects.

Engaging Other Snake River Managers

EPA temperature assessment studies have concluded that the Snake River is the Columbia River tributary with the most significant temperature impact on the Columbia River system. EPA, and States of Oregon, Washington, and Idaho, have made a major region-wide commitment to comprehensive watershed approaches in water quality improvement strategies throughout the Pacific Northwest. A comprehensive watershed approach should be applied to the development of the Columbia and Snake River Mainstem TMDL to understand the full possibilities of measures to reduce water temperature in the Snake River. EPA will commit, working with the States and Columbia Basin Tribes to convene a forum of other Snake River Managers (e.g. Idaho Power and Snake River water users) to identify some possible watershed approaches to improve Snake and Columbia River water temperature problems. The Corps, the Bureau of Reclamation and the Bonneville Power Administration should also plan to attend these meetings and coordinate on this effort. The Western Governors' Association has also indicated a willingness to assist in convening this forum in an effort to support the three states in the development of the Columbia/Snake Mainstem TMDL.

Augmented Temperature Monitoring

The Corps, with the other Action Agencies, should commit to develop and implement an augmented and more comprehensive monitoring program for the Columbia and Snake River mainstem for temperature. The need for improved temperature monitoring was a specific comment directed to EPA in the 1999 peer review of the EPA Temperature Assessment. In response to the peer review, EPA has provided specific recommendations for augmented temperature monitoring in the attached paper, "An Outline of a Monitoring Program for Estimating the State of Water Temperature in the

Columbia and Snake Rivers," prepared by EPA, April 19, 2001, and presented to the Water Quality Team on May 8, 2001. EPA will commit to work with the Corps in the development and review of this monitoring program.

Record of Decision

EPA appreciates the opportunity to work with the Corps staff and the other Action Agencies in the development of the water quality component of the Record of Decision that is due to be issued on May 17, 2001. We are confident that this joint work effort will lead to the development of adequate processes to develop measures for implementation of a water quality improvement strategy for the Columbia River. EPA will continue to work closely with the Corps and the other Action Agencies on the development of this strategy.

We hope this letter will be helpful as we continue to tackle the complex and challenging water quality improvement issues in the Columbia River system. I look forward to the opportunity to discuss these issues further at the upcoming meeting with Colonel Eric Mogren on May 9, 2001.
If you need any further information, please contact me directly at (206) 553-1234 or have your staff contact Mary Lou Soscia at (503) 326-5873.

Sincerely,

Charles E. Findley
Acting Regional Administrator

cc: Stephanie Hallock, Oregon Department of Environmental Quality
Tom Fitzsimmons, Washington Department of Ecology
Steve Allred, Idaho Department of Environmental Quality
Colonel Eric Mogren, U. S. Army Corps of Engineers
Ken Pedde, Bureau of Reclamation
Steve Wright, Bonneville Power Administration
Donna Darm, National Marine Fisheries Service
Bill Shake, Fish and Wildlife Service

Attachment

An Outline of a Monitoring Program for
Estimating the State of Water Temperature
In the Columbia and Snake Rivers

John Yearsley
EPA Region 10
Seattle, Washington

The importance of water temperature for the Columbia River ecosystem has been the topic of scientific analysis and discussion for several decades. The work of Raphael (1962), for example, represents one of the first efforts to apply the energy budget method to a major river system. A workshop convened in 1963 by the Federal Water Pollution Control Commission represented an early effort on the part of regional scientists to discuss biological, physical and chemical effects of water temperature. Davidson (1964) analyzed long term records of the Columbia River for purposes of characterizing the effects of Wells, Rocky Reach, Wanapum and Priest Rapids dams on the temperature of the Columbia River. Davidson (1964) also observed that storage of deep water in Arrow Lake in Canada was a potential source of cold water for a period of 30 to 50 days in the summer. Studies by Battelle (Jaske and Synoground, 1970), under contract to the Atomic Energy Commission (AEC), described the impacts of Grand Coulee Dam and Lake Roosevelt on the temperature regime of the Columbia and also demonstrated the potential for using releases of cold water from Grand Coulee for downstream temperature control.

The Columbia River Thermal Effects Study was initiated by the Department of Interior in January 1968 to develop consistent water quality standards for the states of Oregon and Washington. The study was motivated by the sense that upriver runs of Columbia River fish had been reduced and endangered by the physical alteration and blockage of migration routes by the nation's largest system of dams and reservoirs, and that Columbia River temperatures had been both spatially and temporally altered by man's activities. The research conducted during the study contributed to much of our existing knowledge of temperature effects on Pacific salmon. In addition, the study produced a working mathematical model of water temperature of the Columbia River from the International Border to its mouth near Astoria, Oregon.

The agencies that operate the dams on the Columbia and Snake rivers showed little interest in the results of these studies until recently, when several *Evolutionary Significant Units* were listed as threatened or endangered under the Endangered Species Act, and segments of both rivers were listed as water-quality limited for temperature under Section 303 of the Clean Water Act. This lack of interest is reflected in the state of the temperature monitoring programs on the Columbia and Snake rivers. Prior to 1984, measurements of water temperature in Columbia and Snake consisted of manual observations of temperature from thermometers placed in the cooling water stream of each dam's turbines. These observations, generally described as scroll case measurements were made on a daily basis by dam operations personnel. A recent evaluation of these measurements (Cope, 2001) found many deficiencies in the instruments, in the location of the instruments and the protocols for collecting and reporting data. Many of these deficiencies appeared to be related to the

original motivation for installing the thermometers, which was for purposes of monitoring the operation of turbines rather than for analyzing temperature effects on Pacific salmon.

Temperature monitoring associated with the total dissolved gas program was initiated in 1984 at many of the dams. In contrast to the scroll case temperature monitoring program, the focus of the total dissolved gas monitoring was on characterizing the state of water temperature in the rivers rather than on monitoring the operation of machinery in the project. Nevertheless, the resulting data, as compiled by McKenzie and Laenen (1998) and reported on the Columba River Web site for Data Access in Real Time (DART) site shows a lack of attention to quality control. One also has the feeling that the temperature measurements are primarily an adjunct to the total dissolved gas monitoring rather than an effort to adequately estimate the state of water temperature in the Columbia and Snake rivers. A sample of 29 year-long records on the Columbia River (Columbia River at International Boundary, Columbia River at Grand Coulee) and the Snake River(Ice Harbor Dam forebay and tailrace, Little Goose Dam forebay and tailrace) found that 14 of the records had either large gaps of missing data or large portions of data that were clearly erroneous. Figure 1 is an example of data that are clearly erroneous.

It has become clear that sound scientific methods for estimating the state of water temperature in the Columbia and Snake rivers are needed to address issues of endangered species and failure to meet water quality standards of the states of Idaho, Oregon and Washington. Two essential elements of any monitoring program, elements that are not present in the existing program on the Columbia and Snake rivers, are a clearly defined set of objectives and a well-designed quality assurance/quality control plan. The objective of the monitoring program described below is to obtain adequate state estimates of water temperature in the Columbia and Snake rivers for purposes of developing a Total Maximum Daily Load (TMDL) as required by Section 303 of the Clean Water Act. EPA can also provide technical assistance for development of an adequate quality assurance/quality control plan. The plan of action for dissolved gas monitoring(February 2001) contains many of the concepts that would be needed for an adequate river temperature monitoring program (as noted above, the dissolved gas plan treated water temperature measurements as an adjunct to the total dissolved gas program).

A monitoring program that meets the objectives of developing a temperature TMDL for the Columbia and Snake rivers should include the components described below. This level of monitoring should be conducted for a period of at least five years. After five years, the plan should be revised and modified based on reduced uncertainty in model estimation parameters.

Flow

Daily river flow measurements are required for the main stem Snake and Columbia and for major tributaries. Measurements of river flows, as presently conducted and reported by the USGS, provide an adequate network of data and meet standards of quality control/quality assurance.

Temperature

Water temperature measurements are required at existing total dissolved gas monitoring sites. Additional spatial coverage should be provided at all the total dissolved gas tailrace sites (or at a separate location such as a bridge crossing) that would provide the capability for characterizing the cross-sectional average of water temperature. A minimum design at these sites would be a total of nine locations configured as three equally-spaced moorings across the width of the river, with three temperature probes per mooring at approximately equally-spaced intervals in the vertical. In addition, single, continuous temperature monitoring sites should be located at the mouth of major tributaries including the Kettle River, Colville River, Spokane River, Yakima River, Salmon River, Grande Ronde River and the Clearwater River at Orofino. Weekly observations at smaller tributaries, as described in Yearsley (1999), are needed for the period April-October. Monthly observations in these tributaries are sufficient during the remainder of the year. Particular attention should be given to quality assurance/quality control at all temperature monitoring sites.

Reservoir Elevation

Reservoir elevation measurements are required at all locations presently reported on the Columbia River DART. Particular attention should be given to improving these measurements at Grand Coulee and Dworshak dams, where small errors in the measurement of surface elevation introduce significant error into the water budgets.

Reservoir Operation

Measurements of flow from the various hydroelectric operations are required at all projects. This includes the flow through all turbines, spillway and outlet facilities. These measurements are particularly important at Grand Coulee and Dworshak, where vertical stratification plays in important role in the downstream temperature regime.

River Geometry

Adequate river geometry (river cross-sections in HEC-2 format) are required at approximately one-mile intervals throughout the main stem Snake and Columbia rivers.

Meteorology

An adequate network of weather observations is an essential component of this monitoring program. Weather stations that measure and record wind speed, air temperature, and moisture content (dew point, relative humidity, or wet bulb) should be sited at each hydroelectric project. Cloud cover can be observed at regional sites including the existing first-order stations maintained by the Weather Service. In addition, the U.S. Bureau of Reclamation AGRIMET sites should be modified to include cloud cover measurements.

References

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Davidson, F.A. 1964. The temperature regime of the Columbia River from Priest Rapids, Washington to the Arrow Lakes in British Columbia. *Prepared for the* Public Utility District No. 2 of Grant County, Ephrata, Washington. 31 pp. + tables and figures

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McKenzie, S.W. and A. Laenen. 1998. Assembly and data-quality review of available continuous water temperatures for the main stems of the lower- and mid-Columbia and lower-Snake rivers and mouths of major contributing tributaries. NPPC Contract C98-002, Northwest Power Planning Council, Portland, Oregon.

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Yearsley, J.R. 1999. Columbia River Temperature Assessment – Simulation Methods. EPA Region 10, Seattle, Washington. 388 pp. + appendices.